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(54) **FIDUCIAL DETECTION SYSTEM**

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See application file for complete search history.

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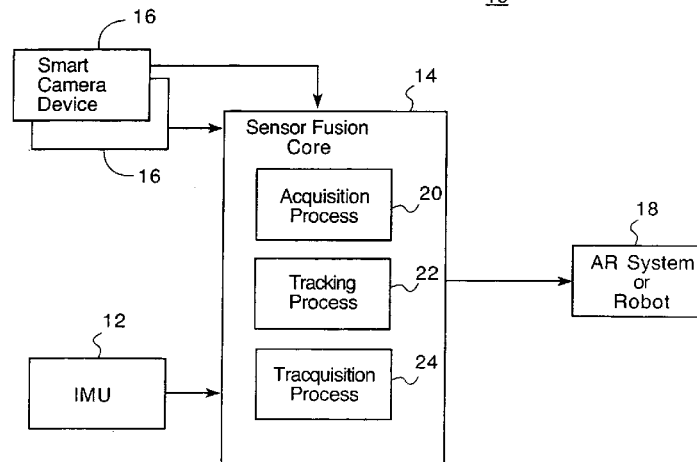
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(57) **ABSTRACT**

A new fiducial design allows having thousands of different codes. These fiducials are printed on a standard black-and-white (or color) printer and easily could be mounted on a walls, ceiling and objects in a room. The design includes "solid" outside mono-color ring and 2-D dense inside coding scheme. Image processing algorithms are implemented in Smart Camera with a built-in DSP to run all required image-processing tasks. A tracking system implementation includes an inertial measurement unit and one outward-looking wide-angle Smart Camera with possible extensions to number of stationary inward-looking cameras. The system operates in various real-world lighting conditions without any user intervention due to homomorphic image processing processes for extracting fiducials in the presence of very non-uniform lighting.

33 Claims, 9 Drawing Sheets